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10/537,161

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Kazuhiko Fukutani

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EXAMINER

BERDICHEVSKY, MIRIAM

ART UNIT

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1795

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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| Office Action Summary | Application No. 10/537,161 | Applicant(s) FUKUTANI ET AL. | |
| | Examiner MIRIAM BERDICHEVSKY | Art Unit 1795 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 August 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-7 and 10-20 is/are pending in the application.
- 4a) Of the above claim(s) 18-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-7 and 10-17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Remarks

Claims 1, 11 and 13-14 are amended. Claims 2 and 8-9 are canceled. Claims 18-20 are withdrawn.

Status of Rejections

All rejections from the previous office action are withdrawn in view of Applicant's amendments.

Claim Interpretation

Regarding claim 1, mainly is given its plan definition chiefly, principally, for the most part, greatly, mightily, abundantly and is interpreted as requiring more than 50% (atomic, weight etc).

Regarding claims 6-7, the specification defines atomic % of silicon or germanium as being a ratio of silicon or germanium atoms to aluminum atoms. However, in the final product aluminum is not present such that the ratio is not valid when examining the final product because product claims do not give weight to product by process limitations. Interpreting the limitation as requiring that the atomic % of silicon or germanium within the porous body be between 20 and 70% contradicts claim 1 which requires that the porous body be mainly silicon or germanium. Therefore, the former is the interpretation from hereon.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 1795

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining

obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1, 3-6, 10-11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ying (US 6231744) and Lieber (US 20020130311).

As to claim 1, Ying teaches a thermoelectric conversion material (col. 4, line 60 to col. 5, line 5) a porous body having columnar pores and a semiconductor material in the pores of the porous body (figure 1) (col. 9, lines 22-37). The Examiner notes that the limitation regarding the formation of the porous body are not given patentable weight

because the claim is a product by process claim and even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (MPEP 2113).

Ying teaches that the matrix material is an anodic aluminum oxide template (col. 5, lines 45-55) and is silent to the porous body being composed of mainly silicon or germanium.

Lieber teaches forming semiconductor nanowires using a porous body filled with semiconductor material (fig. 6) wherein the porous body material can be chosen from silicon and anodic alumina ([0215]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the silicon of Lieber as the material for the porous body in Ying because silicon and anodic alumina are art recognized equivalents for use as templates for semiconductor nanowire formation, as taught by Lieber and selection of a known material based on its suitability for its intended use is merely a matter of design choice within the skill of a worker in the art (MPEP 2144) which would have produced predictable results (MPEP 2141).

Regarding claim 3, Ying teaches that the porous body is in a thin film (col. 9, lines 5-10).

Regarding claims 4-5, the limitation regarding for treating the porous body is a product by process claim and is thus not given patentable weight. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (MPEP 2113).

Regarding claim 6, the specification defines atomic % of silicon or germanium as being a ratio of silicon atoms to aluminum atoms. However, in the final product aluminum is not present such that the ratio is not valid when examining the final product because product claims do not give weight to product by process limitations.

Regarding claim 10, Ying teaches that the average diameter of the columns (pores) is 8nm (col. 6, lines 23-26).

Regarding claim 11, Ying teaches keeping the cell size (figure 2: spacing + column/pore diameter) small (col. 11, lines 40-48) and teaches that the cell size can be manipulated by voltage (col. 12, lines 1-26) but is silent to a spacing of between 5 and 20nm.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a spacing of between 5 and 20nm in Ying because to optimize the nanowire growth template especially since it has been held to be within ordinary skill of a worker in the art to determine the optimal value of a result effective variable (MPEP

Art Unit: 1795

2144.05). Too small a spacing risks malformed pores while too large of a spacing lessens the density of wires produced by a single template.

Regarding claim 13, Ying teaches a thermoelectric conversion device comprising the material according to claim 1 (col. 4, line 60 to col. 5, line 5).

5. Claims 1, 7 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ying, Someya (US 20030147801) and Doremus (Glass Science).

As to claim 1, Ying teaches a thermoelectric conversion material (col. 4, line 60 to col. 5, line 5) a porous body having columnar pores and a semiconductor material in the pores of the porous body (figure 1) (col. 9, lines 22-37). The Examiner notes that the limitation regarding the formation of the porous body are not given patentable weight because the claim is a product by process claim and even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (MPEP 2113). Ying teaches that the matrix material is an anodic aluminum oxide template (col. 5, lines 45-55).

Ying is silent to the porous body being mainly silicon or germanium.

Someya teaches that silica glass and anodized aluminum are art recognized equivalents in the manufacture of nanostructures ([0016]).

Doremus teaches that silica glass and germania glass are art recognized equivalents (page 38). Germania glass is mainly germanium by mass.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use germania glass in Ying because germania glass is similar in structure to silica glass, as taught by Doremus such that use of the material would have been obvious to try with reasonable predictions of success and predictable results (MPEP 2141 III).

Regarding claims 7, the specification defines atomic % of silicon or germanium as being a ratio of silicon atoms to aluminum atoms. However, in the final product aluminum is not present such that the ratio is not valid when examining the final product because product claims do not give weight to product by process limitations.

Regarding claim 12, modified Ying teaches the use of Germania glass (amorphous) (Dormeus: page 38). It would have been obvious to one of ordinary skill in the art at the time of the invention to use glass in Ying because glass is an art recognized equivalent of anodized alumina, as taught by Someya such that use of the material would have been obvious to try with reasonable predictions of success and predictable results (MPEP 2141 III) and because amorphous materials are cheaper than crystalline materials.

6. Claims 14-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ying and Someya.

As to claim 14, Ying teaches a method of manufacturing a thermoelectric material comprising: providing a structure in which a plurality of columns of a column forming material containing a first component distributed in a matrix material containing (figure 1), removing the column forming material to form a porous body (figure 1, (col. 5,

Art Unit: 1795

lines 14-40), introducing a semiconductor material into the porous body (col. 5, line 43 to col. 6, line 5). Ying teaches that the material used to form the columns is anodic aluminum oxide (aluminum containing) (col. 5, lines 45-55).

Ying is silent to the two components being different such that there is a eutectic between the components wherein the column forming material contains aluminum and the matrix material contains silicon, germanium or silicon germanium.

Someya teaches that anodized aluminum and silica-alumina are art recognized equivalents in the manufacture of nanostructures ([0016]). Silica contains silicon.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use silica-alumina in Ying because silica-alumina has heat, acid and alkali stability as taught by Someya ([0016]) and use of the material would have been obvious to try with reasonable predictions of success and predictable results (MPEP 2141 III). Achieving the eutectic depends on the concentration of components. Silica-alumina is a composite of two different materials; the properties of composites depend on both materials. Changing the concentration of each component effects the properties of the composite and is a result effective variable. One of ordinary skill in the art would appreciate that optimizing the composition of the silica-alumina composite to maximize the properties of the material is within the skill of a worker in the art (MPEP 2144).

Regarding claims 15-16, Ying teaches oxidizing the porous body after the removal step (col. 5, lines 22-25).

Regarding claim 17, Ying teaches filling the pores using electrodeposition (col. 9, lines 45-50).

Response to Arguments

Applicant's arguments with respect to claims 1 and 14 have been considered but are moot in view of the new ground(s) of rejection as necessitated by amendment.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **MIRIAM BERDICHEVSKY** whose telephone number is (571)270-5256. The examiner can normally be reached on M-Th, 10am-8pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Michener can be reached on (571) 272-1424. The fax phone

Art Unit: 1795

number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. B./

Examiner, Art Unit 1795

/Jennifer K. Michener/

Supervisory Patent Examiner, Art Unit 1795